Asplenium Linn., sect. Thamnopteris Presl

by

R. E. Holttum
Royal Botanic Gardens, Kew

Summary

The status of this section (also known as a genus *Neottopteris* J. Sm.) is discussed. A key to all known species is provided, with synonymy and a brief description for each. The importance of growth-habit (not shown by herbarium specimens) is stressed, and the need for more observation of living plants, especially on the islands of the Pacific Ocean. Two new species (*A. pacificum* and *A. spirale*) are described. Names of species which have been included by various authors in *Neottopteris* but which do not belong to this section are listed.

This section was established by Presl in 1836 (Tent. Pterid. 105); the sole species was *Asplenium nidus* L. and the only distinctive character described was the anastomosis of veins near the margin of the lamina. John Smith raised the section to generic rank in 1841 (Hook. Journ. Bot. 3:409 and 4:175) with citation also of other species. He chose a new generic name *Neottopteris,* and gave the superfluous new name *N. vulgaris* to the type species, listing *A. nidus* Linn. as a synonym; this was corrected when Hooker described and illustrated the genus in his *Genera Filicum* (1842) t. 113B. Presl later used the generic name *Thamnopteris* (Epim. Bot. 68; 1851) and in this was followed by Beddome (Handb. Ferns Br. India, 1883) but at the generic level *Neottopteris* has priority; it should be noted also that in 1849 Brongniart published the generic name *Thamnopteris* for a fossil fern stem of the family Osmundaceae.

The group of species which conform to Presl's description is certainly a natural one, but a decision on its status should be deferred until a scheme for a natural division of the large genus *Asplenium* (estimated 700 species) is established. On this subject Copeland made the following comments (Gen. Fil. 167; 1947): "in a genus so large, there are of course natural groups of species, some of them easily recognizable .... these groups are remarkably indefinable". He did not refer to John Smith's *Historia Filicum* (pp. 316–321; 1875) in which *Asplenium* is divided into many sections and subsections. In spite of Copeland, and without agreeing in detail with John Smith's arrangement, it seems to me probable that *Asplenium* could be subdivided into natural groups of species if someone would take time to make in intensive survey of the whole of it, noting characters not hitherto incorporated into specific descriptions.

John Smith (l.c. p. 316) cited *A. marinum* L. as type species, but Copeland (Gen. Fil. 164) cited *A. trichomanes* L. without mentioning Smith, whose selection should have priority. It appears to me that a considerable number of tropical species including the widely distributed *A. tenerum* Forst. are related to *A. marinum;* and in my book on the Ferns of Malaya (p. 415) I have noted the possibility that *A. nidus* belongs to this alliance. Therefore it is possible that if the genus *Asplenium* as now recognized were divided into several distinct genera,

A. nidus and near allies would remain as a section of *Asplenium* s. str. For this reason I do not here recognize *Neottopteris* as a genus. I think it important that a full survey of *Asplenium* should be undertaken, so that natural groups of species can be found and delimited. Whether or not such groups are regarded as distinct genera, their recognition would provide a basis for comparative studies of a kind which are not now possible, and the distribution of the various groups would help towards an understanding of the possible history of *Asplenium* sens. lat. As Copeland has remarked, there is a tendency within *Asplenium* towards the reduction of fronds from a much-divided to a less divided condition, with the result that simple fronds, like those of *A. nidus,* have originated on various evolutionary lines. Paired sori facing each other have developed in some of these simple fronds; this is the *Phyllitis* (Scolopendrium) condition. Hooker (Spec. Fil. vol. 3) put all these species into a suborder Scolopendrieae and arranged them in four sections of *Scolopendrium* (others have since been discovered); but they are the ends of several evolutionary lines within *Asplenium* s. l. and we shall not well understand them until the species within *Asplenium* related to each are recognized. Section *Thamnopteris* is undoubtedly a distinct section, as shown by its venation and its distribution; it is in fact the only section of *Asplenium* which can at present be clearly delimited.

The characters of sect. *Thamnopteris* are: caudex erect, slow-growing, unbranched, bearing at its apex a series of almost sessile simple fronds in a very close spiral so that together they form a nest-like structure (except *A. spirale* and possibly *A. longum*); veins slender, parallel, close together, often forking once, less often twice, their tips always united in a series of short arcs just within the cartilaginous margin of the lamina; sori elongate, with narrow indusium; spores usually with a narrow translucent wing and some anastomosing cross wings. Distribution: tropics and subtropics of the Old World from East Africa to Hawaii; mostly epiphytes, but a few species specialized to a habitat on limestone rocks.

Cytology. In northern India Bir found n = 72 (tetraploid) for both *A. nidus* and *A. phyllitidis* (Current Science 29: 445; 1960); Abraham, Ninan and Matthew made the same observation for both species in southern India (Ind. Journ. Bot. 41 : 381; 1962). Vazart reported that a plant of *A. nidus* of unspecified origin, cultivated at Paris, had n = 144 (i.e. octoploid; Rev. Cyt. Biol. Veg. vol. 17, 1956) but his statement is not clearly expressed and needs confirmation.

The opposite key covers all species I have been able to discover. It needs to be critically considered by people who have access to living plants, especially on the islands of the Pacific Ocean. An important character in plants of this section is habit of growth, especially the angle each frond makes at its base with the vertical line of the caudex, and the curvature of the midrib. This character is not shown by herbarium specimens, and I have seen no reference to it in taxonomic works on ferns. Works on cultivated ferns sometimes describe habit, but may be unreliable in the use of names. Schneider's "Book of Choice Ferns" (3 volumes, 1892–1894) is still the most comprehensive of these. His published figure of *A. nidus* (vol. 1 p. 618) shows a plant with the habit of *A. australasicum;* but under *A. nidus* var. *australasicum* he describes the growth-habit typical of *A. nidus,* though associating it with the character of a keeled midrib, a condition I have not seen. Under *A. nidus* var. *musifolium* he states that the fronds "take an upright direction from the start" and that the sori extend nearly to the edge; neither statement is correct (the second probably copied from Hooker; see note on

A. musifolium below). I have seen no plants in cultivation in Britain which correspond to Schneider's description of var. *musifolium*. Under *A. nidus* in Nicholson's Dictionary of Gardening (vol. p. 132; 1884) and in the R. H. S. Dictionary of Gardening (vol. 1 p. 205; 1951) are published almost identical habit-drawings which correspond to *A. australasicum*. Bailey's Cyclopaedia of Horticulture (vol. 1 p. 414, edition of 1939) gives a different habit-drawing, also corresponding to *A. australasicum* but with the name *A. nidus*. In Exotica 3, pp 822 and 824 (1962) A. B. Graf publishes photographs of plants which have the habit of *A. australasicum*, though the fronds have wider basal halves than those now cultivated in Britain and those illustrated in the British publications quoted above.

The shape of fronds, even on the same plant, is somewhat variable, especially the shape of the apex, which is often damaged during the rather long period in which it remains in a tender actively-growing state (it is the last part of the frond to become hardened). Width of fronds certainly varies according to light intensity in plants of *A. nidus* in Malaya, as I have proved experimentally by taking a plant with narrow fronds from the weak light in which it was growing to a stronger light; the next frond was more than twice as wide as preceding ones. This is also true of plants in cultivation at Kew. But my impression is that in some other species (*A. phyllitidis,* and probably *A. australasicum*) this response to stronger light does not occur; in Malaya, *A. phyllitidis* does not grow in such exposed positions as *A. nidus*.

As herbarium specimens do not clearly indicate the curvature of the base of the frond, even if the base is present (often it is not), one object of the present account is to call attention to the need for field observation of the habit of growth. John Smith recognized this a century ago when he wrote: "The cultivated examples of four forms known to me, although difficult to recognize as distinct when put in the Herbarium, are however readily seen to be distinct species in the garden" (Historia Filicum, p. 329). He was implicitly criticizing W. J. Hooker, who did not pay sufficient attention to the living plants under John Smith's care at Kew.

Key to the Species of sect. Thamnopteris

1. Fronds gradually narrowed from their widest part to the base
    2. Sori on almost all veins, including both branches of a vein which forks near costa; indusia less than $\frac{1}{2}$ mm wide
        3. Fronds nest-forming
            4. Fronds ascending steeply; nest narrowly funnel-shaped
                5. Costa sharply keeled on lower surface .... 1. *A. australasicum*
                5. Costa not keeled on lower surface ...... 2. *A. pacificum*
            4. Fronds spreading horizontally at base and then curved upwards
                6. Fronds to c. 20 cm wide; apex gradually attenuate .... 3. *A. nidus*
                    7. Fronds unlobed and flat

8. Sori usually much more than 10 mm long
    9. Sori on basal $\frac{1}{3}-\frac{1}{2}$ (rarely $\frac{2}{3}$) of each vein .... var. *nidus*
    9. Sori on middle part of each vein .... var. *biseriale*
8. Sori not more than 10 mm long .... var. *curtisorum*

7. Fronds much lobed, or plicate
    10. Fronds much lobed .... var. *multilobum*
    10. Fronds plicate .... var. *plicatum*

6. Fronds 25–35 cm wide; apex broadly rounded .... 4. *A. musifolium*

3. Fronds not nest-forming
    11. Fronds to at least 70 x 10 cm .... 5. *A. longum*
    11. Fronds to c. 25 x 5 cm .... 6. *A. spirale*

2. Sori usually on one branch of each vein, indusium more than $\frac{1}{2}$ mm wide
    12. Fronds to 20 cm or more wide with dilated bases; indusia more than 1 mm wide .... 7. *A. cymbifolium*
    12. Fronds not over 12 cm wide, bases not dilated; indusia less than 1 mm wide
        13. Fronds of mature plants to at least 9 cm wide; costa little or not prominent on lower surface
            14. Wing of spores with short broad projections; sori not more than half length of veins .... 8. *A. carinatum*
            14. Wing of spores uniformly narrow; sori $\frac{3}{4}$ length of veins .... 9. *A. antiquum*
        13. Fronds of mature plants in many cases narrower; costae distinctly prominent on lower surface
            15. Fronds 3–4 cm wide; sori lying in a depression in the dried lamina, the depression with a distinct outer edge .... 10. *A. colubrinum*
            15. Fronds in some cases wider; sori not lying in a depression
                16. Fronds to 3 cm wide; scales on stipe not more than 5 mm long; sori at c. 45° to midrib .... 11. *A. simonsianum*
                16. Fronds commonly 4–8 cm wide (exceptionally wider); scales 10 mm or more long; sori usually at a wider angle ... 12. *A. phyllitidis*
                    17. Wings of spores of uniform width; fronds never more than 8 cm wide .... subsp. *phyllitidis*

17. Wings of spores bearing many slender projections equal in length to more than ½ width of spore; fronds sometimes to 12 cm or more wide .... subsp. *malesicum*

1. Fronds with basal half or more narrow and sterile, abruptly widened to fertile distal half
    18. Rhizome-scales c. 5 x 1½ mm; costa keeled on lower surface .... 13. *A. grevillei*
    18. Rhizome-scales 3–4 mm wide, little longer than wide; costa not keeled on lower surface
        19. Sterile base of frond 1½ cm wide at base, widening to 2½ cm .... 14. *A. antrophyoides*
        19. Sterile base of frond a very narrow wing, grading imperceptibly to a stipe .... 15. *A. humbertii*

1. **Asplenium australasicum** (J. Sm.) Hook., Fil. Exot. (1859) t. 88; Mett., Farngatt. VI (1859) 85. — *Neottopteris australasica* J. Sm., Cult. Ferns (1857) 49; Hist. Fil. (1875) 330. — *Thamnopteris australasica* (J. Sm.) Moore, Ind. Fil. (1859) 115. Type: cult. Hort. Bot. Kew., origin Australia (BM, in herb. J. Sm.).

Fronds to c. 100 x 15 cm, ascending at a small angle to vertical, together forming a funnel-shaped nest; frond widest just above middle, gradually narrowed towards base; midrib strongly and acutely keeled on lower surface; veins, sori and spores as in *A. nidus*, but sori often occupying more than half of the length of a vein. Hooker figures the base of the frond somewhat dilated, but this is not always so.

Distribution: Queensland and New South Wales; Norfolk Isl., Lord Howe Isl., New Caledonia, Fiji, Samoa, Tonga, Tahiti.

2. **Asplenium pacificum** Holtt., **sp. nov.**

Ab Asplenio nido differt: frondibus e basi suberectis, congerie frondium ut in A. australasicum infundibuliformi, sed costis subtus latis, paulo elevatis, non carinatis.

Largest frond seen 60 x 12 cm, widest about middle, gradually tapering to rather wide base and more narrowly to apex; small scales on lower surface very few, irregularly stellate with some dark-walled cells in the centre, terminal cells of arms not elongate; costa dark, broad, slightly prominent and rounded on lower surface, strongly prominent on upper surface; sori on all veins, from near midrib, extending a little more than half-way towards margin.

Type: cult. Hort. Bot. Kew., accession no. 584/65, grown from spores collected on Washington Island by W. A. Sledge (K).

3. **Asplenium nidus** L., Spec. Pl. (1753) 1079; Holtt., Rev. Fl. Mal. 2 (1955) 419. — *Neottopteris vulgaris* J. Sm. in Hook. Journ. Bot. 3 (1841) 409; 4 (1841) 175, nom. nov. superfl. — *Neottopteris nidus* (L.) Hook., Gen. Fil. (1842) t. 113B; Brack. in Wilkes U.S. Expl. Exp. 16 (1854) 175. — *Thamnopteris nidus* (L.) Presl, Epim. Bot. (1851) 68; Bedd., Handb. Ferns Br. India (1883) 137. Type: Osbeck s.n., Java (LINN).

Asplenium ficifolium Goldm., Nova Acta Acad. Leop. Carol. 19, Suppl. 1 (1843) 461. Type: Meyen s.n., Manila (B, not seen).

Neottopteris stenocarpa Fée, Gen. Fil. (1852) 203. Type: Cuming s.n., Philippines (not seen).

Neottopteris elliptica Fée, Gen. Fil. (1852) 203. Type: Cuming s.n., Philippines (not seen).

Neottopteris mauritiana Fée, Gen. Fil. (1852) 204. — *Thamnopteris mauritiana* Presl, Epim. Bot. (1851) 68, nom. nud. Type: Sieber, Fl. Maurit. 46 (isotype K).

Neottopteris rigida Fée, Gen. Fil. (1852) 203. Type: Henslow s.n., Macao (not seen).

Neottopteris salwinensis Ching, Bull. Fan. Mem. Inst. Biol. Ser. 2, 1 (1949) 304. Type: T. T. Yu 19163, N. W. Yunnan, Salwin valley (PE, not seen).

Var. nidus. Fronds to about 150 x 20 cm, narrowed gradually to base and apex, at base growing out horizontally and curved gradually upwards; costa broad but only slightly prominent (not keeled) on lower surface, strongly prominent and ± 2-angled on upper surface except near base; small scales on lower surface of lamina of young fronds, near base, stellate with black-walled cells in centre, end-cells of rays pale, short, thin-walled; sori on all veins, usually extending from costa not more than $\frac{1}{2}$ way towards edge; indusia less than $\frac{1}{2}$ mm wide.

Distribution: E. Africa (Dar es Salaam, Tanzania Zanzibar); Madagascar, Mascarene Islands, Seychelles, Ceylon & S. India, N. E. India; Indo-China & S. W. China; Malesia; Solomon Islands to Tahiti and Hawaii.

Throughout much of its range, var. *nidus* is represented by abundant plants which grow in fairly exposed positions on branches of trees; these plants vary much in size, according to habitat conditions. Though I have not seen the types of Fée's species which are placed above as synonyms, I do not think that they are distinguishable entities; they differ in size and shape of fronds, length of sori etc, all very variable characters. In the Pacific region it appears that *A. nidus* and *A. australasicum* both occur in Samoa, and there the variation is greater than in the Malayan region. In the 1880's Thomas Powell sent many specimens to Kew, with annotations in which he attempted to distinguish several distinct varieties or species, but not all his specimens were kept, and those at present in the herbarium at Kew do not appear to me to show enough recognizable characters to establish new names. I have described var. *biseriale* from one collection of Powell's (see below) which he pointed out as most distinctive. He also stated that he regarded *A. australasicum* as distinct. It is possible that some of the variation in Samoa is due to hybridization between *A. nidus* and *A. australasicum;* a new local survey of these plants might yield interesting results. A similar survey is also desirable in other island-groups of the Pacific.

Var. bieriale Holttum, **var. nov.**; a varietate typica differt soris media venarum occupantibus, nec costam nec marginem accedentibus, lamina basi leviter dilatata.

Type: T. Powell 240, Samoa (K). See above discussion.

Var. curtisorum (Chr.) Holtt., **var. nov.** — *Asplenium curtisorum* Chr., Ann. Jard. Bot. Btzg 19 (1904) 39. — *Neottopteris curtisora* Hosokawa, Trans Nat. Hist. Soc. Formosa 31 (1941) 474. Type: Sarasin 2034, Gimpu, Central Celebes, 5 Sept. 1902.

The original specimens was described as having fronds 50 x 9 cm, short-acuminate, with sori about 10 mm long; there is no information about width of indusia. A report from the University Herbarium at Basel states that the type is not with the earlier Sarasin collections from Celebes; it may be at Paris. In Kew

herbarium are specimens, as cited below, from Sabah and Sarawak which conform to the above description, also a plant from Sabah in cultivation at Kew. But there are other specimens from Borneo with sori 12–15 mm long, and I am not sure that var. *curtisorum* is sharply distinct.

Price's specimen from Mindanao has fronds 17 cm wide and sori 8–10 mm long close to the midrib. The collector reports that when fresh the upper surface of the midrib was prominent and rounded in section, not 2-angled as it usually is in *A. nidus*, but the dried specimens do not show this clearly so that a comparison with the Bornean specimens cannot be effectively made.

SABAH. Elmer 20943, Tawao. Cult. R. B. G. Kew, accession no. 455/63, origin Sabah (no locality) leg. Giles & Wolliams. SARAWAK. Clemens 21011, Mt Matang. Brooks s.n. Aug. 1909, without locality (BM). JAVA. Donk s.n. 5.4.1950, near Tjibodas (K).

PHILIPPINES. M. G. Price 2752, Mindanao, Agusan del Norte Prov., mountains above Cabadbaran.

Var. multilobum F. M. Bailey, Queensl. Agric. Journ. 1 (1897) 370, with photo. Type: Bailey s.n., Trinity Bay Ranges, N. Queensland (isotype K).

Fronds irregularly and deeply lobed; midrib pale in distal part (apparently dark near base), rather broad and rounded on lower surface; sori irregular, in some cases in pairs facing each other, as in *Phyllitis*.

It is possible that this should rank as a variety of *A. australasicum;* the Kew specimen consists of the apical part of the frond, and has slight indications of a keel on the lower surface of the midrib, which however is very broad, due probably to the frequent branchings. I have seen no later specimens, and have no information whether this variety persists.

Var. plicatum v.A.v.R., Handb. Malayan Ferns (1908) 440. Type: not cited, apparently at BO, from a cultivated plant.

Plant rather small, with lamina on each side of the midrib plicate or crimped so that it will not lie flat. A plant of this nature in cultivation at Kew has very thick rigid fronds; its origin is not recorded.

4. **Asplenium musifolium** Mett., Farngatt. VI (1859) 86; Hook., Spec. Fil. 3 (1860) 78, p.p. — *Thamnopteris nidus* var. *musifolia* Bedd., Handb. Ferns Br. India (1883) 139, p.p. — *Asplenium nidus* var. *musifolium* v.A.v.R., Handb. Mal. Ferns (1908) 439, p.p.; Holttum, Rev. Fl. Mal. 2 (1955) 418. Type: Cuming 89, Luzon p.p. (isotype K).

Asplenium nidiforme v.A.v.R., Bull. Jard. Bot. Btzg II, 7 (1912) 6; Handb. Suppl. (1917) 281. Type: Cult. Hort. Bog. II K XIV 39, origin New Guinea (BO).

Fronds growing out horizontally at the base, then curved upwards as in *A. nidus*, those of well-grown plants 25–35 cm wide, base gradually and then abruptly narrowed to a black stipe, apex rather abruptly and broadly rounded with a short mucro; costa rather strongly prominent on lower surface but not keeled; sori as in *A. nidus*.

Extreme forms of this look distinct from *A. nidus* (small plants also have proportionately broad fronds), but it is desirable to establish its distinctness by growing plants from spores.

Cuming's collection no. 89, on a specimen from which Mettenius based the first published description, was a mixed gathering, part being as described above

and part being from a plant of *A. cymbifolium* (no. 7 below). Mettenius's specimen is probably lost with the destruction of the Leipzig herbarium, but his description leaves no doubt as to its identity, matching exactly a specimen of no. 89 in the Kew herbarium. Hooker's description of 1860 covers both species, including the statement that in one "form" the sori may reach almost to the edge of the lamina (this "form" was *A. cymbifolium*), and this was copied by Beddome and van Alderwerelt. John Smith first published the name as *Neottopteris musifolia*, citing Cuming 89, but without a description; he wrote the name *N. musifolia* on a specimen of *A. cymbifolium* in his herbarium, and may have intended it for that species, which is strikingly distinct, but the type of *A. musifolium* must be the specimen described by Mettenius.

The type specimen of *A. nidiforme*, of which I have seen a photograph, has fronds to 50 x 12½ cm, and I judge that it was an immature plant; the shape of frond is like that of *A. musifolium*.

A specimen from the Admirality Islands (Challenger Expedition, 1875) in the BM herbarium consists of a frond of the form of *A. musifolium*, 22 cm wide, but the midrib is decidedly keeled on the lower surface, as in *A. australasicum*. The curvature of the base of the frond cannot be judged. This is another indication of the complexity of sect. *Thamnopteris* in the Pacific, and of the need for more observation.

A plant in cultivation at Kew, from N. E. New Guinea (accession no. 247/70, 2351) has fronds of about the same size and shape as the type of *A. nidiforme*, but it has small scales on the lamina as in *A. phyllitidis*, and the spores are abortive: it is probably a hybrid.

5. **Asplenium longum** v.A.v.R., Bull. Jard. Bot. Btzg II, 28 (1918) 8. Type: Bünnemaijer 2131, Bangka, Mt Mangkol (BO; phot. at BM). — *Asplenium perlongum* v.A.v.R., l.c. Type Bünnemeijer 1846, Bangka, Mt Maras (BO; Phot. at BM).

"Not nest-forming" (v.A.v.R.); fronds of type of *A. longum* 70–80 x 10–15 cm, of *A. perlongum* to 145 cm long; sori of former not touching costa, of latter touching costa; little other clear difference. The photographs of type specimens do not indicate how the growth habit differs from that of *A. nidus*, nor is there clear distinction in form of fronds and sori. I place this species here to call attention to its description, in the hope that further information about plants on the island of Bangka may be obtained.

6. **Asplenium spirale** Holtt., **sp. nov.**

Caudex elongatus, c. 8 mm diametro, paleis nigris angustis c. 8 mm longis vestitus, frondes laxe spiraliter ferens. Stipes anguste alatus, 1–2 cm longus, lamina rigida, 18–24 cm longa, 4.2–5.0 cm lata, leviter oblanceolata, basi subabrupte ad alam angustata, apice late vel anguste acuta, non cuspidata; costa utrinque paulo elevata; venae more A. nidi prope marginem anastomosantes, c. 1 mm inter se distantes, sub angulo c. 45° a costa abeuntes; sori e costa dimidio marginem versus producti, indusia vix ½ mm lata; sporae alis angustis praeditae.

Type: Pulle 184, Lorentz River, W. New Guinea, 30 m (BM).

The fronds are shaped about as in *A. musifolium* but are small and rigid; they are attached to the caudex in an ascending spiral arrangement so that about 8 fronds are attached to a length of caudex 5 cm long. Thus the habit is quite distinct from that of *A. nidus*.

7. **Asplenium cymbifolium** Chr., Bull. Herb. Boiss. II, 6 (1906) 999; v.A.v.R., Handb. (1908) 440; Copel., Philip. Journ. Sci. 2C (1907) 130; Fern Fl. Philip. (1960) 451. — *Neottopteris cymbifolia* (Chr.) Tagawa, Journ. Jap. Bot. 22 (1949) 161. Type: Loher s.n., Mt Makiling, Luzon (P, not seen).

Fronds similar in size and shape to those of *A. musifolium* but broader and dilated in basal part; veins about 2 mm apart in middle of lamina; sori not on every vein, rather irregular in spacing and length, many extending almost to edge of lamina; indusia a little more than 1 mm wide. Scales on rhizome up to 4 mm wide; rather pale; small scales also abundant on edges of costa near base of frond.

Distribution: S. Sumatra, Borneo, Philippines, New Guinea, Samoa.

As noted above under *A. musifolium*, Cuming included specimens of this species under his no. 89. Mr Michael Price informs me that the species grows in the mossy forest near the summit of Mt Makiling, and that the bases of the fronds overlap so closely that the "nest" holds water. Roots of the fern grow up into the water, and tree-frogs lay eggs in it.

Forma lingganum v.A.v.R., Bull. Jard. Bot. Btzg III, 5 (1922) 184. Type: Bünnemeijer 7388, Lingga Arch., P. Singkep (BO; isotype K). Fronds to 60 x 6 cm, base dilated as in type of species; sori short. This may be a young plant. It appears to have been found in mangrove, where high average atmospheric humidity encourages abundant epiphytic growth on certain species of trees in quite bright light; some of these species do not occur in normal lowland forest in Malaya, but occur further north on mountains (e.g. *Ctenopteris moultonii* (Copel.) Holtt.)

8. **Asplenium carinatum** v.A.v.R., Bull. Jard. Bot. Btzg II, 28 (1918) 9. Type: Teysmann 12791, Maros, S. W. Celebes (BO).

Fronds 40–50 x 9 cm; apex rather abruptly short-pointed to cuspidate; lower part of frond gradually narrowed towards base, a very narrow wing extending almost to attachment of frond to caudex; costa strongly keeled on upper surface, not on lower; veins at c. 60° to costa; sori from costa along basal half of veins, or shorter, on alternate veins; indusium more than ½ mm wide; spores with wing of irregular width, not produced into filaments as in *A. phyllitidis* subsp. *malesicum*.

Only known from two collections from the type locality; the second is C. J. Brooks 16856 (BM), found growing on limestone near Maros Waterfall. This habitat is interesting, in view of the fact that species 13–15 of the present account occur only on limestone in mainland Asia.

9. **Asplenium antiquum** Makino, Journ. Jap. Bot. 6 (1929) 32; Tagawa, Col. Ill. Jap. Pterid. (1962) 147, 177, fig. 324. — *Thamnopteris antiqua* Makino, Journ. Jap. Bot. 8 (1932) 7. — *Neottopteris antiqua* Massumune, Trans. Nat. Hist. Soc. Formosa 22 (1932) 215. Type: "Hab. Japan, southern", not seen.

Fronds to c. 100 x 12 cm, narrowed gradually to base and more abruptly to apex; costa broad and only slightly prominent on lower surface, little more so on upper; veins in middle of lamina more than 1 mm apart; sori on alternate veins, ⅔ or more of length of veins; indusia more than ½ mm wide; spores winged as in *A. nidus*.

Distribution: Kyushu (Yakushima Isl.), Izu Isl., Okinawa.

10. **Asplenium colubrinum** Chr., Bull. Herb. Boiss. II, 6 (1906) 999; Copel., Fern Fl. Philip. (1960) 451. Type: Loher s.n. March 1906, Angilog, Luzon (P?; isotype K). Also cited Loher 18.4.1905, Mt Batay, 1380 m.

Fronds to almost 100 cm long, 3–4 cm wide, firm texture, rather uniform in width for a great part of their length, narrowed gradually to both base and apex which is sometimes short-acuminate; costa keeled on lower surface, not on upper; sori on alternate veins, occupying $\frac{3}{4}$ or more of length of veins, the sporangia lying in a depression in a dried frond, the edge of the depression distinct; indusia a little more than $\frac{1}{2}$ mm wide; spores with a narrow wing.

Distribution: Luzon, Mindoro.

Copeland described a variety *taeniophyllum* (Philip. Journ. Sci. 2C: 131; 1907) based on a specimen collected by Merrill (no. 5900) on Mt Halcon, Mindoro. He described the sori as occupying $\frac{1}{2}$–$\frac{3}{5}$ of the veins, with black indusia. I have not seen a specimen, but have seen another from Mt Halcon (Ramos & Edano 40623) which does not differ significantly from Loher's Luzon specimens.

Mr M. G. Price has recently sent a specimen (no. 440) from Mt Polis, Luzon, which agrees with the above description except that the sori do not lie in a depression in the surface of the frond. The fronds of this specimen are thinner than those of the type. The species is thus perhaps chiefly distinguished by its long narrow fronds.

11. **Asplenium simonsianum** Hook., Ic. Plant. 10 (1854) t.925. — *Thamnopteris simonsiana* (Hook.) Moore, Ind. Fil. (1857) L; Bedd., Handb. Ferns Br. India (1883) 141. — *Neottopteris simonsiana* J. Sm., Hist. Fil. (1875) 330. Type: Simons 232 (err. typ. 432 in Hook. l.c.), Khasya (K).

Scales dark, firm, 2–3 x 1 mm; stipe c. 2 cm long; frond to 40 x 3 cm, widest $\frac{1}{3}$ from apex, very gradually narrowed towards base, basal part a very narrow wing on each side of costa, apex rather abruptly narrowed to a cusp 15–20 mm long, $1\frac{1}{2}$–2 mm wide; costa prominent on both sides near base, rounded on lower side, on upper side grooved at base, above base raised and 2-angled when dry; veins at c. 45° to costa, distinct but not or little prominent either side; sori from near costa $\frac{3}{4}$ towards edge, usually with a sterile vein between sori; indusia over $\frac{1}{2}$ mm wide when young; spores with translucent narrow somewhat crisped wing.

Distribution: Assam, Sikkim, Chittagong, Vishakapatanam, on hills at about 3000 ft.

12. **Asplenium phyllitidis** Don, Prodr. Fl. Nepal. (1825) 7; Hook., Spec. Fil. 3 (1860) 80. excl. syn. *A. simplex* Bl. — *Neottopteris phyllitidis* (Don) J. Sm. in Hook. Journ. Bot. 3 (1841) 409. — *Thamnopteris phyllitidis* (Don) Presl, Epim. Bot. (1851) 68; Bedd., Ferns S. India (1863) t. 123. — *Thamnopteris nidus* var. *phyllitidis* Bedd., Handb. Ferns Br. India (1883) 139. — *Asplenium nidus* var. *phyllitidis* v.A.v.R., Handb. Suppl. (1917) 282; Tard. & C. Chr. in Fl. Gen. Indochine 7, pt. 2 (1940) 220. Type: Wallich, Nepal (not seen).

Thamnopteris orientalis Presl, Epim. Bot. (1851) 69; Holtt., Novit. Bot. Inst. Bot. Univ. Carol. Prag. 1968 (1969) 52. Type: Wallich 198, Nepal ? (PRC). In the Wallich Herbarium at Kew, there are 9 sheets of 198. not all from Nepal; only two agree with Presl's specimen.

Subsp. phyllitidis

Scales at least 10 mm long; fronds commonly 40–70 cm long, 4–8 cm wide, widest above middle, gradually narrowed to base, apex rather narrowly pointed or short-cuspidate; costa prominent and rounded on lower surface, on upper surface grooved near base, above base slightly prominent and 2-angled; veins c. $1\frac{1}{2}$ mm

apart mid-way between costa and edge, uniting 1 mm or more from edge; sori from near midrib $\frac{2}{3}$–$\frac{3}{4}$ length of veins, usually on acroscopic branch of a vein which forks near costa, at an angle of more than 45° to costa; indusia more than $\frac{1}{2}$ mm wide; spores with a narrow wing.

Distribution: S. India, N. E. India, N. Thailand, Yunnan, Hainan.

Subsp. malesicum Holttum, **subsp. nov.,** a subspecie phyllitidi differt frondibus saepe majoribus, usque 12 (–15) cm latis, sporis semper ciliatis. Type: Cuming 319, Samar (K).

Asplenium nidus var. *simonsianum* sensu Chr., Bull. Herb. Boiss. 6 (1898) 151.

Asplenium oblanceolatum Copel., Philip. Journ. Sci. 9C (1914) 229. Type: Brooks 28, Lebong Tandai, Benkoelen, Sumatra (BM).

Asplenium phyllitidis sensu Holtt., Rev. Fl. Mal. 2 (1955) 420; sensu Copel., Fern Fl. Philip. (1960) 449.

Asplenium simplex sensu Kunze, Bot. Zeit. 6 (1848) 145; sensu Mett., Farngatt. VI (1859) 86; non Bl.

Thamnopteris simplex sensu Presl, Epim. Bot. (1851) 69, non (Bl.)

Fronds commonly to 100 x 8 cm, sometimes to 10–12 (–15) cm wide; sori varying in length, usually $\frac{2}{3}$–$\frac{3}{4}$ length of veins but sometimes shorter; spores always with a translucent wing which is produced into many slender points equal in length to more than half width of spores; scales on lower surface of young fronds, near base, very small, middle cells with pale walls, fringed with elongate orange glandular cells (these scales not seen on specimens of subsp. *phyllitidis*).

Distribution: throughout Malesia; in mainland Asia northwards to southern Burma and Thailand and to Tonkin.

In New Guinea there appears to be more variation than elsewhere. Two distinct forms are in cultivation at Kew, but herbarium specimens from New Guinea are in some cases intermediate. In one cultivated plant the nest has a very wide open base, fronds of a yellow-green colour, sori not over $\frac{2}{3}$ length of veins at a rather broad angle to costa, small scales on lower surface near base abundant; the other cultivated plant has more erect fronds (forming a less open nest) which are darker green, with sori almost the full length of the veins and at about 45° to costa, superficial small scales fewer with glandular cells less conspicuous.

13. **Asplenium grevillei** Wall. ex Hook. & Grev., Ic. Fil. (1831) t. 228. Tard. & C. Chr. in Fl. Gen. Indoch. 7, pt. 2 (1940) 217. — *Neottopteris grevillei* (Wall.) J. Sm. in Hook. Journ. Bot. 3 (1841) 409. — *Thamnopteris grevillei* (Wall.) Moore, Ind. Fil. (1857) L; Bedd., Handb. Ferns Br. India (1883) 139. Type: Wallich 1036, Tavoy, Burma (K).

Scales not well seen, apparently to 5 x 1$\frac{1}{2}$ mm, firm but thin; stipe very short; frond to 45 cm long, basal 20–25 cm a narrow wing on each side of costa, up to 1 cm wide or little more, rather abruptly widening to 4$\frac{1}{2}$–6 cm wide in distal part; texture thin; costa keeled on lower surface; veins c. 1 mm apart, at c. 60° to costa; sori from near costa $\frac{3}{4}$ or more towards edge; spores translucent with a narrow wing.

Distribution: Peninsular Burma and Peninsular Thailand; S. India and Ceylon.

14. **Asplenium antrophyoides** Chr., Bull. Geogr. Bot. Mans 20, pt. 1 (1909) 170, Tard. & C. Chr. in Fl. Gen. Indoch. 7, pt. 2 (1940) 218 — *Neottopteris antrophyoides* (Chr.) Ching, Bull. Fan Mem. Inst. Biol. Bot. 10 1941) 7. Type: Cavalerie 1877, Sept. 1907, Kweichow, Lo-fou (P).

Asplenium subspathulatum Rosenst. in Fedde. Rep. 13 (1913) 122. Type: Cavalerie s.n. Kweichow (isotype BM).

Scales c. 4 x 4 mm; fronds to c. 40 x 7 cm, spathulate, abruptly cuspidate, sessile; basal 15–17 cm gradually widening from base to 2½ cm wide, then less abruptly than in *A. grevillei* to the wide distal part; veins in broad part of frond c. 1½ mm apart; sori from 3–5 mm from costa to ¾ distance to edge, at c. 60° to costa; spores not translucent, with a fairly wide somewhat crisped wing.

Distribution: Kweichow, Tonkin, N. Thailand, on limestone.

15. **Asplenium humbertii** Tard., Aspl. du Tonkin (1932) 25, t. 2, f. 1, 2. Tard. & C. Chr. in Fl. Gen. Indoch. 7, pt. 2 (1940) 218. — *Neottopteris humbertii* (Tard.) Tagawa, Journ. Jap. Bot. 22 (1949) 161. Type: Balansa 68, Tonkin, Than Moi, sur les rochers calcaires, Jan. 1886 (P; K).

Scales as in *A. antrophyoides;* basal part of frond very narrow, 15–20 cm long, apical fertile part to 23 x 4.8 cm, apex abruptly cuspidate; sori from near costa along ⅔–¾ of veins.

Distribution: Tonkin, North Thailand, on limestone.

This species is very near *A. antrophyoides*, but appears to be distinct in the very narrow basal part of the frond. Specimens in Kew herbarium from N. Thailand are variable in the angle between sori and costa.

Excluded species which have been included in *Neottopteris*

Neottopteris squamulata (Bl.) Fée, Gen. Fil. (1852) 203 — *Asplenium squamulatum* Bl., Enum. Pl. Jav. (1828) 174. — *Thamnopteris squamulata* (Bl.) Presl, Epim. Bot. (1851) 260. Type: Blume, Java (L).

Neottopteris pachyphylla (Kunze) Fée, Gen. Fil. (1852) 203. — *Asplenium pachyphyllum* Kunze, Bot. Zeit. 6 (1848) 146. — *Thamnopteris pachyphylla* (Kunze) Presl, Epim. Bot. (1851) 69. Type: Zollinger 2414, Java (isotype K). = *A. squamulatum* Bl.

Neottopteris simplex (Bl.) Fée, Gen. Fil. (1852) 203. — *Asplenium simplex* Bl., Enum. Pl. Jav. (1828) 174, non Kunze Bot. Zeit. 6 (1848) 145, nec Mett. Farngatt. VI (1859) 86. — *Thamnopteris simplex* (Bl.) Presl, Epim. Bot. (1851) 69. Type: Blume, Java (L.) — *A. amboinense* Willd. sensu Backer & Posth., Varenfl. Java (1939) 133, but doubtfully identical with Willdenow's species, the type of which is a sterile frond.

Neottopteris taeniosa (Kunze) Fée, Gen. Fil. (1852) 203. — *Asplenium taeniosum* Kunze, Bot. Zeit. 6 (1848) 145. Type: Zollinger 2823, Java (isotype K). = *A. simplex* Bl.

Neottopteris stipitata J. Sm. and *N. ovata* J. Sm. are nomina nuda which have been cited by other authors but have no status.